

Inventor: **Hirokazu Iguchi**  
U.S. Serial No. **09/700,171**

Group Art Unit: **1713**  
Examiner: **Rip A. Lee**

### **REMARKS**

Claims 1-8 are pending in the present application. Claim 1 is herein amended. Claims 3-8 are herein added, and find support in the specification on page 7, lines 14-27; page 8, lines 6-17; page 11, line 9; and page 12, lines 26-27.

### **Claim Objections**

Claim 1 is objected to because the claim recites the quotient  $\eta_{sp}/c$ . The Examiner asserts that the definition of term  $c$  in the denominator is unclear.

Applicants respectfully disagree with this objection, and submit that it is well known that " $\eta_{sp}/c$ " denotes "reduced viscosity". The measuring conditions of temperature, solvent and concentration are defined in claim 1. Accordingly, Applicants submit that there is no lack of clarity in the quotient  $\eta_{sp}/c$ . Nevertheless, Applicants herein amend claim 1 to more fully define the terms of the quotient.

### **Rejections under 35 U.S.C. §103(a)**

Applicants note that the present invention is based on the discovery that an acrylic rubber-based graft copolymer which has a relatively low content of a crosslinked rubber component as compared with conventional graft copolymers, and which contains a methyl ethyl ketone-soluble portion having a very high molecular weight such that the reduced viscosity is from 1 to 5, can remarkably improve the Gardner impact strength of vinyl chloride resin

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compositions containing a large amount of calcium carbonate which improves the Izod impact strength and flexural modulus but remarkably deteriorates the Gardner impact strength when used in an amount of 10 parts by weight or more. Comparative Examples 7 and 8 demonstrate that the Izod impact strength and flexural modulus are improved by increasing the amount of calcium carbonate, but the Gardner impact strength is remarkably deteriorated. From these results, it would be readily understood that the Gardner impact strength is remarkably deteriorated if calcium carbonate is used in a large amount in order to further improve the Izod impact strength and flexural modulus of vinyl chloride resins incorporated with an impact modifier. Comparative Examples 1 and 5 demonstrate that even if an acrylic graft copolymer is incorporated into vinyl chloride resins containing a large amount of calcium carbonate, the Gardner impact strength is still low if the reduced viscosity of the MEK-soluble portion of the graft copolymer is less than 1. From comparison between Example 1 and Comparative Example 1 and between Example 6 and Comparative Example 5, it is found that such deterioration of Gardner impact strength caused by calcium carbonate can be prevented by the incorporation of a specific acrylic graft copolymer even if the calcium carbonate is used in an amount of 10 parts by weight or more.

*Claims 1 and 2 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,996,173 to Heichele et al. in view of U.S. Patent No. 5,693,699 to Bertelo et al.*

The Examiner asserts that Heichele et al. relates to polyvinyl chloride molding compositions comprised of 80-98% (by weight) of polyvinyl chloride, 2-20% of an impact

modifying resin, and 2-30% of calcium carbonate. The Examiner asserts that Bertelo et al. relates to a reinforcing composition for vinyl chloride polymer; that the composition is comprised of calcium carbonate and an impact additive, such as ABS and MBS resins ; and that graft polymers are particularly preferred. The Examiner asserts that a reasonable basis exists to believe that it inherently possesses the same physical properties disclosed in the claims of the present invention, namely, a  $\eta_{sp}/c$  value of 1-5 at 30°C for a 0.2 g/100 mL acetone solution.

The Examiner asserts that Heichele et al. and Bertelo et al. disclose similar compositions (i.e., polyvinyl chloride, impact modifier, and calcium carbonate), and Bertelo et al. shows that graft copolymers may be used in lieu of standard impact modifiers. Therefore, the Examiner asserts that it would have been obvious to one having ordinary skill in the art to use the graft copolymer cited in Bertelo et al. in the composition of Heichele et al. in order to make material based on polyvinyl chloride, and one would have expected such a material to exhibit the desired impact resistant properties. The Examiner asserts that with respect to Claim 2, it would be obvious to make some type of article from said composition, thereby imparting some utility to the extant polymeric mixture.

Applicants respectfully disagree with the rejections, and note that French patents 2,551,446 and 2,551,447 disclose graft copolymer including a backbone made from a C<sub>2</sub>-C<sub>12</sub> alkyl acrylate, 0.5-30 % of a conjugated diene and optionally a crosslinking agent, onto which C<sub>1</sub>-C<sub>4</sub> alkyl methacrylate and C<sub>1</sub>-C<sub>8</sub> alkyl acrylate are grafted. On the other hand, the

specification discloses at page 7, lines 11-13 and 21-22 that the crosslinked elastomeric polymer backbone may contain units of a conjugated diene.

In order to more fully distinguish the claimed graft copolymer from those disclosed in the French patents, Applicants herein amend Claim 1, line 18 to insert --selected from the group consisting of monomers having a single vinyl group and organosiloxanes-- after “therewith”. This amendment is supported by the specification disclosure at page 7, lines 11-13.

As recognized by the Examiner, the cited reference does not disclose the use of a graft copolymer as presently claimed, which contains a crosslinked acrylic elastomer and the methyl ethyl ketone-soluble portion of which has a reduced viscosity of 1 to 5.

Bertelo et al. discloses a reinforcing composition for vinyl chloride polymer, comprising:

a) a synergic combination of a micronized silica and at least one calcium salt such as calcium carbonate, and

b) an impact additive selected from graft copolymers derived from a conjugated diene such as butadiene or isoprene, e.g., ABS resin, MBS resin, and graft copolymers as disclosed in French patents 2,551,446 and 2,551,447 which are graft copolymers including a backbone consisting of a random copolymer of a conjugated diene, a C<sub>2</sub>-C<sub>12</sub> alkyl acrylate and optionally a crosslinking agent onto which are grafted chains of a copolymer of C<sub>1</sub>-C<sub>4</sub> alkyl methacrylate and C<sub>1</sub>-C<sub>12</sub> alkyl acrylate and optionally a crosslinking agent onto which are grafted chains of a copolymer of C<sub>1</sub>-C<sub>4</sub> alkyl methacrylate and C<sub>1</sub>-C<sub>8</sub> alkyl acrylate (column 2, line 55 to column 3, line 13).

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The graft copolymers disclosed in Bertelo et al. or the French patents are those including a backbone derived from a conjugated diene, and are different from the presently claimed graft copolymer.

Accordingly, even if the graft copolymer disclosed in Bertelo et al. is used in the composition of Heichele et al., the thus-modified vinyl chloride molding composition is still different from the presently claimed vinyl chloride resin composition.

Further, none of the cited references teach or suggest the advantages produced by the specific acrylic graft copolymer defined in the Applicants' claims, so there is therefore no suggestion to combine the cited references.

*Claims 1 and 2 are rejected under 35 U.S.C. §103(a) as being unpatentable over Heichele et al. in view of Aoyama et al.*

The Examiner asserts that Aoyama et al. discloses a graft copolymer comprising 15-50 parts (by weight) of a graft monomer component made of 30-100% (by weight) of a methyl methacrylate and 0-70% of a monomer selected from the group consisting of C<sub>1</sub>-C<sub>8</sub> alkyl acrylate, C<sub>2</sub>-C<sub>6</sub> alkyl methacrylate, unsaturated nitrile, and aromatic vinyl compounds. The Examiner concludes that the composition disclosed in Aoyama et al. is identical to that recited in Claim 1 of the present application. The Examiner asserts that a reasonable basis exists to believe that it inherently possesses the same physical properties disclosed in the claims of the present application, namely a  $\eta_{sp}/c$  value of 1-5 at 30°C for a 0.2 g/100 mL acetone solution.

Applicants respectfully disagree with the rejection.

Applicants note that Aoyama et al. discloses a vinyl chloride resin composition comprising:

- a) 50 to 97 parts (by weight) of a vinyl chloride resin, and
- b) 50 to 3 parts of a graft copolymer prepared by graft-polymerizing, onto 50-85 parts of a crosslinked acrylic rubber, 15-50 parts of a graft monomer component composed of 30-100 % (by weight) of methyl methacrylate and 0-70 % of a monomer selected from the group consisting of C<sub>1</sub>-C<sub>8</sub> alkyl acrylates, C<sub>2</sub>-C<sub>6</sub> alkyl methacrylates, unsaturated nitriles and aromatic vinyl compounds, wherein the fraction extracted from the graft copolymer with methyl ethyl ketone (MEK) has a specific viscosity of at least 0.6 as measured at a concentration of 0.1 g/100 cc in acetone at 30°C.

The reduced viscosity  $\eta_{sp}/c$  is calculated from the equation of specific viscosity  $\eta_{sp}$  concentration  $c$  (g/dl). Accordingly, the specific viscosity  $\eta_{sp}$  of at least 0.6 corresponds to a reduced viscosity of at least  $0.6/0.1 =$  at least 6, which is larger than the claimed range of 1 to 5.

Accordingly, even if the graft copolymer disclosed in Aoyama et al. is used in the composition of Heichele et al., the thus-modified vinyl chloride molding composition is still different from the presently claimed vinyl chloride resin composition.

Further, Aoyama et al. does not teach or suggest the specific acrylic graft copolymer defined in Applicants' claims and the advantages produced thereby. Aoyama et al. is addressed to improvement in impact resistance-impairing effect of an acrylic rubber-based graft copolymer. Aoyama et al teaches increasing the rubber content in the graft copolymer in order to improve the

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impact resistance-imprinting effect (column 1, lines 47-49) rather than decreasing the rubber content in the graft copolymer to 75% by weight or less as presently claimed. In order to solve agglomeration problem resulting in poor powder state encountered when increasing the rubber content, Aoyama et al teaches increasing the molecular weight of the graft phase to a specific viscosity of at least 0.6, and in order to solve the die swelling problem encountered when increasing the molecular weight of the graft phase, Aoyama et al. teaches conducting the graft polymerization in two stages (column 1, line 47 to column 2, line 20, column 2, line 65 to column 3, line 32, and column 5, lines 41-50). Aoyama et al. does not teach or suggest that Gardner impact strength, which is deteriorated when a large amount of calcium carbonate is incorporated into a vinyl chloride resin in order to improve the Izod impact strength and flexural modulus, can be improved by maintaining the rubber content in an acrylic graft copolymer relatively low and increasing the molecular weight of the graft phase to a reduced viscosity of 1 to 5.

For at least the foregoing reasons, Applicants submit that the claimed invention as amended distinguishes over the cited art and defines patentable subject matter. Favorable reconsideration is earnestly solicited.

Should the Examiner deem that any further action by Applicant would be desirable to place the application in condition for allowance, the Examiner is encouraged to telephone Applicant's undersigned attorney.

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In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 01-2340.

Respectfully submitted,

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**Version With Markings to Show Changes Made**

**IN THE CLAIMS:**

1. (Amended) A vinyl chloride resin composition having excellent weatherability and impact resistance which comprises:

(a) 100 parts by weight of a vinyl chloride resin,

(b) 1 to 10 parts by weight of a graft copolymer which is obtained by polymerizing 25 to 75 parts by weight of a graft monomer component to 25 to 75 parts by weight of a crosslinked elastomeric polymer so that the total thereof is 100 parts by weight, and the methyl ethyl ketone-soluble portion of which has an a reduced viscosity  $\eta_{sp}/c$ , where  $\eta_{sp}$  is specific viscosity and c is concentration of polymer in solvent in g/100 mL, of 1 to 5 measured at 30°C with respect to its 0.2 g/100 cc acetone solution,

said graft monomer component being composed of 40 to 100% by weight of methyl methacrylate and 0 to 60% by weight of at least one monomer selected from the group consisting of an alkyl acrylate having a C<sub>1</sub> to C<sub>8</sub> alkyl group, an alkyl methacrylate having a C<sub>2</sub> to C<sub>6</sub> alkyl group, an unsaturated nitrile and an aromatic vinyl compound, and said crosslinked elastomeric polymer being composed of 79.9 to 99.99 % by weight of an alkyl acrylate having a C<sub>2</sub> to C<sub>8</sub> alkyl group, 0.01 to 5% by weight of a polyfunctional monomer and 0 to 20% by weight of other monomers copolymerizable therewith selected from the group consisting of monomers having a single vinyl group and organosiloxanes, and

(c) 10 to 30 parts by weight of calcium carbonate.

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**Please add new claims 3-8 as follows:**

3. (New) The composition of Claim 1, wherein said methyl ethyl ketone-soluble portion has a reduced viscosity  $\eta_{sp}/c$  of 1.5 to 4.
4. (New) The composition of claim 1, wherein said other monomers in said crosslinked elastomeric polymer are a member selected from the group consisting of alkyl acrylates other than those having a C<sub>2</sub> to C<sub>8</sub> alkyl group, other acrylic esters, methacrylic esters, acrylic acid, metal salts of acrylic acid, acrylamide, aromatic vinyl compounds and their derivatives, acrylonitrile, methacrylonitrile, vinyl ether compounds, vinyl ester compounds, vinyl halides, vinylidene halides, cyclic siloxanes, alkoxysilanes and methacryloyloxysiloxanes.
5. (New) The composition of Claim 1, wherein said graft copolymer is composed of 35 to 70 parts by weight of a graft monomer component and 30 to 65 parts by weight of a crosslinked elastomeric polymer, the total being 100 parts by weight.

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6. (New) The composition of Claim 1, wherein said graft monomer component is composed of 60 to 100 % by weight of methyl methacrylate and 0 to 40% by weight of at least one monomer selected from the group consisting of an alkyl acrylate having a C<sub>1</sub> to C<sub>8</sub> alkyl group, an alkyl methacrylate having a C<sub>2</sub> to C<sub>6</sub> alkyl group, an unsaturated nitrile and an aromatic vinyl compound.

7. (New) The composition of Claim 1, wherein said graft monomer component is a mixture of methyl methacrylate and up to 40 % by weight of at least one monomer selected from the group consisting of an alkyl acrylate having a C<sub>1</sub> to C<sub>8</sub> alkyl group, an alkyl methacrylate having a C<sub>2</sub> to C<sub>5</sub> alkyl group, an unsaturated nitrile and an aromatic vinyl compound.

8. (New) The composition of Claim 1, wherein the amount of said calcium carbonate is from 15 to 25 parts by weight based on 100 parts by weight of said vinyl chloride resin.